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Proceedings of the PSARC Groundfish Subcommittee Meeting November 12-14, 2002

J. Fargo
Groundfish Subcommittee Chair

Fisheries and Oceans Canada
Pacific Scientific Advice Review Committee
Pacific Biological Station
Nanaimo, British Columbia V9T 6N7

December 2002

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PACIFIC SCIENTIFIC ADVICE REVIEW COMMITTEE (PSARC)
GROUNDFISH SUBCOMMITTEE MEETING

SUMMARY 2

SOMMAIRE 4

INTRODUCTION 6

DETAILED COMMENTS FROM THE REVIEW 6

G2002-02: 2002 Inshore rockfish conservation strategy for the west coast of Canada 6

G2002-03: Update assessment of Silvergray rockfish (*Sebastes brevispinis*) 8

G2002-04: At-sea observer coverage for catch monitoring of the British Columbia hook and line fisheries 10

G2002-05: A review of Pacific Cod (*Gadus macrocephalus*) monitoring surveys in Hecate Strait March – July 2002 11

G2002-06: West Coast Vancouver Island Pacific Cod assessment: 2002 12

APPENDIX 1. WORKING PAPER SUMMARY 14

APPENDIX 2: PSARC GROUNDFISH SUBCOMMITTEE MEETING AGENDA NOVEMBER 12-14, 2002 18

APPENDIX 3. LIST OF ATTENDEES 19

SUMMARY

The PSARC Groundfish Subcommittee met on three occasions in 2002. A planning meeting was held on May 23, 2002 to identify working papers required for 2002. A technical meeting was held on September 20 to review data and methods used in the 2002 assessments. The final meeting was held November 12-14, 2002 to review the assessments and provide scientific advice.

Working Paper G2002-02: 2002 Inshore rockfish conservation strategy for the west coast of Canada

The Subcommittee referred the paper back to the Rockfish Conservation Working Group to make revisions and resolve the lack of consensus about reconciling management objectives with a stock assessment strategy. The Subcommittee acknowledged that further collaboration is necessary between Science and Management to produce a final document. The Subcommittee invited the Rockfish Conservation Working Group to table a detailed outline that represents a consensus view at a future Groundfish PSARC meeting, prior to developing the outline into a final working paper.

Working Paper G2002-03: Update assessment of Silvergray rockfish (*Sebastes brevispinis*)

Yield estimates were presented for four stocks of silvergray rockfish based on a catch-age analysis tuned with commercial and research survey CPUE. The model fit to the data was best with a low weighting on CPUE. Estimated yields in this assessment did not differ substantially from those in the last assessment. Differences in recommended yield between this assessment and the last reflected the addition of new fishery and biological data along with the utilization of tuning indices. The Subcommittee endorsed the yield recommendations in the Working Paper.

Working Paper G2002-04: At-sea observer coverage for catch monitoring of the British Columbia hook and line fisheries

The Subcommittee found that the analysis was thoroughly conducted and useful in portraying the complexity of the issue. However, by focusing on total catch as opposed to approaching the issue as one of obtaining observer estimates of discards, the conclusions tended to overestimate the required observer coverage for species where discarding is low. It was clear that the design of the current program is not adequate for producing reliable estimates of coverage. The Subcommittee noted that these points must be clear in the conclusions section in the working paper. There was consensus that data from the International Pacific Halibut Commission (IPHC) should be acquired to move this work forward because the halibut fishery could account for a large percentage of the discarding and hence the error in estimates of total catch. The Subcommittee accepted the Working Paper subject to revisions. The Subcommittee

also recommended that a DFO groundfish data committee be established to discuss data sharing for the halibut fishery with IPHC staff.

Working Paper G2002-05: A review of Pacific Cod (*Gadus macrocephalus*) monitoring surveys in Hecate Strait March – July 2002

A monitoring survey for Pacific cod in Hecate Strait was designed and implemented in 2002. The survey is an ongoing collaboration between the Canadian Groundfish Research and Conservation Society and DFO. The Subcommittee agreed that the survey design was sound and the results from the first year were encouraging. The working paper was accepted subject to minor revisions

The Subcommittee made the following recommendations:

1. The survey should be conducted as designed for as long as required to assess the status of Pacific cod.
2. A discussion on management decision rules should be initiated for all levels of abundance.
3. The utility of the survey for indexing the abundance of other species caught should be investigated.

Working Paper G2002-06: West Coast Vancouver Island Pacific Cod assessment: 2002

This paper focused on a CPUE index for Pacific cod arising from an annual shrimp trawl survey off the west coast of Vancouver Island. The authors compared this index to the commercial fishery index for Pacific cod in this area. They concluded that the index provided by the shrimp survey was a viable proxy for fishery CPUE. This becomes another important monitoring tool when the WCVI commercial Pacific cod fishery is opened with severely reduced Total Allowable Catch (TAC) levels as it was recently. The Subcommittee felt that the survey index could be used for monitoring the status of the stock and harvest recommendations. The Subcommittee accepted the Working Paper.

The Subcommittee endorsed the authors' recommendations to:

1. Adopt yield estimates based on the model results that incorporate all three sets of available data (mean weight, shrimp trawl indices and catches). Yield forecasts and their implications on stock size are summarized in Table 1.
2. Revise the existing Pacific cod delay difference model to allow the assessment of uncertainty associated with the model parameters and predictions. An alternative formulation where the model is conditioned on catch rather than the present formulation where it is conditioned on effort should also be investigated.

SOMMAIRE

Le Sous-comité du CEESP sur le poisson de fond s'est réuni à trois reprises en 2002 : une réunion de planification s'est tenue le 23 mai afin de déterminer les documents de travail nécessaires pour 2002; une réunion technique s'est tenue le 20 septembre afin d'examiner les données et les méthodes utilisées dans les évaluations de 2002; la réunion finale a eu lieu du 12 au 14 novembre afin d'examiner les évaluations et de fournir des conseils scientifiques.

Document de travail G2002-02 : Stratégie de conservation du sébaste côtier de la côte Ouest du Canada - 2002

Le Sous-comité renvoie le document au groupe de travail sur la conservation du sébaste afin de le réviser et d'établir un consensus sur la conciliation des objectifs de gestion et de la stratégie d'évaluation du stock. Le Sous-comité reconnaît que les divisions des sciences et de la gestion doivent collaborer davantage afin d'élaborer la version finale du document. Il invite le groupe de travail sur la conservation du sébaste à présenter, à une réunion future du CEESP sur le poisson de fond, une ébauche détaillée du consensus établi en vue de s'en servir pour élaborer le document de travail final.

Document de travail G2002-03 : Mise à jour de l'évaluation du sébaste argenté (*Sebastes brevispinis*)

Le document présente les estimations de la production de quatre stocks de sébaste argenté basées sur une analyse des prises selon l'âge pondérée en fonction des PUE de la pêche commerciale et des relevés scientifiques. Les données se conforment mieux au modèle lorsque la pondération des PUE est faible. Les estimations de production de cette évaluation étaient semblables à celles de la dernière évaluation. Les différences entre la production recommandée dans cette évaluation et celle de l'évaluation précédente reflètent l'ajout de nouvelles données halieutiques et biologiques et l'utilisation d'indices de pondération. Le Sous-comité approuve les recommandations en matière de production présentées dans le document de travail.

Document de travail G2002-04 : Niveau de présence des observateurs en mer pour le contrôle des prises de la pêche à la ligne en Colombie-Britannique

Le Sous-comité estime que l'analyse a été réalisée de manière rigoureuse et qu'elle illustre bien la complexité de la question. Cependant, en se concentrant sur le total des prises plutôt qu'en abordant la question du point de vue de l'estimation par les observateurs des prises rejetées, les auteurs ont eu tendance à surestimer le niveau de présence d'observateurs requis pour les espèces peu rejetées. Il est évident que le programme actuel ne permet pas d'obtenir des estimations fiables du niveau de présence. Le Sous-comité indique que ces remarques doivent être énoncées clairement dans la conclusion du document de travail. Il est convenu à l'unanimité que l'acquisition de données de la Commission internationale du flétan du Pacifique (CIFP)

est nécessaire pour poursuivre ce projet puisque les pêcheurs de flétan pourraient être responsables d'une grande part des prises rejetées et donc de l'erreur des estimations du total des prises. Le Sous-comité approuve le document de travail à condition que des corrections y soient apportées. Il recommande également la création d'un comité du MPO sur les données de la pêche au poisson de fond pour discuter du partage de ces données avec le personnel de la CIFP.

Document de travail G2002-05 : Examen des relevés de surveillance de la morue du Pacifique (*Gadus macrocephalus*) dans le détroit d'Hécate (de mars à juillet 2002)

Le Canadian Groundfish Research and Conservation Society et le MPO ont collaboré à la conception et à la réalisation d'un relevé de surveillance de la morue du Pacifique dans le détroit d'Hécate en 2002. Le Sous-comité reconnaît que le relevé était bien conçu et que les résultats de la première année sont encourageants. Il a également approuvé le document de travail à condition que des corrections mineures y soient apportées.

Le Sous-comité fait les recommandations suivantes :

1. Le relevé devrait être effectué tel que conçu et aussi longtemps que nécessaire pour évaluer l'état de ce stock de morue du Pacifique.
2. Il faudrait entreprendre une discussion sur les règles de décision de gestion pour tous les niveaux d'abondance.
3. L'utilité du relevé pour déterminer l'indice d'abondance des autres espèces capturées devrait être étudiée.

Document de travail G2002-06 : Évaluation d'un stock de morue du Pacifique de la côte Ouest de l'île de Vancouver en 2002

Ce document porte sur un indice de PUE pour la morue du Pacifique calculé à partir de données obtenues lors du relevé annuel au chalut à crevettes effectué au large de la côte Ouest de l'île de Vancouver (COIV). Les auteurs ont comparé cet indice à celui de la pêche commerciale à la morue du Pacifique dans cette zone. Ils ont conclu que l'indice obtenu à partir du relevé au chalut à crevettes était une bonne approximation des PUE. Cet indice constitue donc un autre outil de surveillance important lorsqu'on fixe des totaux autorisés des captures (TAC) très réduits pour la pêche commerciale à la morue du Pacifique le long de la COIV, comme c'était le cas récemment. Le Sous-comité estime que l'indice du relevé pourrait être utilisé afin de surveiller l'état du stock et de faire des recommandations en matière de récolte et il a approuvé le document de travail.

Le Sous-comité a approuvé les recommandations suivantes faites par les auteurs :

1. Estimer la production au moyen d'un modèle qui intègre les trois jeux de données disponibles (poids moyen, indices de relevés au chalut à crevettes et prises). Les

prévisions de la production et les tailles du stock correspondantes sont résumées dans le Tableau 1.

2. Réviser le modèle à différences retardées actuel pour la morue du Pacifique afin de permettre l'évaluation de l'incertitude liée aux paramètres et aux prévisions du modèle. Étudier également la possibilité de fonder le modèle sur les prises plutôt que sur l'effort, tel qu'il est conçu actuellement.

INTRODUCTION

The PSARC Groundfish Subcommittee met November 12-14, 2002, at the Pacific Biological Station in Nanaimo, British Columbia. External participants from the Canadian Groundfish Research and Conservation Society, Canadian Sablefish Association, Hul'qumi'num Treaty Group, Hook and Line Groundfish Association, Sport Fish Advisory Board, Pacific Halibut Management Association, Georgia Strait Alliance, Pacific Fisheries Management Inc., and the Sierra Club of B.C. attended the meeting. The Subcommittee Chair, J. Fargo, opened the meeting by welcoming the participants. During the introductory remarks the objectives of the meeting were reviewed, the confidential nature of the discussion was highlighted, and the Subcommittee accepted the meeting agenda.

The Subcommittee reviewed five Working Papers. Summaries of the Working Papers are in Appendix 1. The meeting agenda appears as Appendix 2. A list of meeting participants, observers and reviewers is included as Appendix 3.

DETAILED COMMENTS FROM THE REVIEW

G2002-02: 2002 Inshore rockfish conservation strategy for the west coast of Canada

L. Yamanaka and L.C. Lacko **Paper referred back to the Rockfish Conservation Working Group**

Subcommittee discussion focused on two themes: (1) the degree to which the paper met anticipated objectives, and (2) technical issues regarding the estimation of fishing mortality and the uncertainty of the fishery decision rule (instantaneous fishing mortality of $F<=0.015$).

The Subcommittee suggested that there was some confusion as to the objectives of the working paper. One of the reviewers felt that the working paper should have addressed specific elements of stock assessment that determined the frequency and scale of proposed activities that would allow senior management to anticipate resource requirements. The Subcommittee felt that future plans for management of the fishery were not integrated with science programs such as the estimation of target fishing mortality reference points or monitoring of closed areas. For example, designing stock assessment programs for estimating stock biomass for a fishery managed primarily

through catch controls is quite a different problem than designing programs to evaluate the effectiveness of management through large-scale closed areas. One conclusion of the discussion was that the product anticipated by fishery managers was more along the lines of a 5 or 10-year research and monitoring work-plan that would be used to evaluate the performance of the current fishery decision rule and the effectiveness of closed areas. A reviewer felt that specific research programs laid out as an experiment to address catchability of these species should have been further developed to identify how such work would support management objectives and provide details of the experimental plan, anticipated data and analysis, and resource requirements. The Subcommittee felt that the objective of achieving a stock assessment framework in support of management required more collaboration between science and fishery management staff concerning the identification of fishery controls, rebuilding targets, and time frames for achieving stock status milestones. It was also suggested that some effort for scientific work should be directed toward quantifying the uncertainties in the evaluation of the harvest rate, and in outlining specific scientific programs for acquiring data that were missing such as habitat quality and the selection of closed areas, and improved catch monitoring.

Technical discussion on methodology focused on quantification of uncertainty in estimating total mortality, and hence fishing mortality. It was pointed out that estimates of total instantaneous mortality, Z, were based on catch at age truncated at age class 60 for inshore yelloweye rockfish but the same analysis for the Bowie Seamount population was truncated at age class 100. It was noted that the confidence bounds for Z, and hence F, provided in the paper reflects only the uncertainty about the regression line and do not include observation error or sensitivity of the analysis to the assumption of constant average recruitment. When this uncertainty is quantified, the likely result is that the upper bound will increase, which implies that more conservative harvests will be required to ensure target F values are achieved. The Subcommittee noted that while selecting F=0.015 may be a robust and precautionary fishing level for an operational fishery, lower harvest rates may actually be needed to achieve rebuilding. One reviewer suggested that open areas only should be used for exploitation calculations. The Subcommittee pointed out that overfishing of open areas was a danger if stock mixing rates were low and if reserves (closed areas) were the only sources of recruitment.

A reviewer also noted a number of technologies for research exploration such as stereo video technology, multi-beam laser and camera systems and suggested that, while expensive, these may provide the only accurate method of stock monitoring for these species.

One of the reviewers concluded that the paper presented a case for conservation measures for inshore rockfishes and represented the beginning of a plan to ensure long-term conservation measures. The other reviewer recommended rejection of the paper because it did not integrate science programs and management objectives.

Conclusions

The Subcommittee concluded that the working paper did not represent a consensus of the Rockfish Conservation Working Group with respect to objectives and deliverables. In the view of the Subcommittee, the lack of consensus cannot be resolved by minor revision of the document, although the Subcommittee acknowledged the efforts of the authors to advance a conceptual approach to a stock assessment plan.

Recommendations

The Subcommittee referred the paper back to the Rockfish Conservation Working Group to achieve a consensus among the working group members. The Subcommittee invited the Rockfish Conservation Working Group to table a detailed outline that represents a consensus view at a future Groundfish PSARC meeting, prior to development of the outline into a final working paper.

G2002-03: Update assessment of Silvergray rockfish (*Sebastes brevispinis*)

R. Stanley and N. Olsen **Paper accepted subject to revisions**

Abundance was characterized for four stocks of silvergray rockfish using a catch-age analysis tuned with survey and fishery Catch Per Unit Effort (CPUE). A yield estimate for each stock was derived from terminal biomass estimates. Results from the analysis showed that abundance for three of the four stocks was stable while one stock was declining in abundance. The uncertainty around stock abundance as measured in the analysis suggests that small differences in biomass between the last assessment and this one are probably not meaningful. The Subcommittee highlighted the fact that silvergray rockfish stocks would decline over the next several years if recruitment of 1990s year-classes is poor due to unfavorable environmental conditions. In that case, it may be necessary to define the critical stock level that is necessary to protect the stocks from recruitment overfishing. The authors noted that this would require consideration of stock/recruitment dynamics and that current stock reconstruction data are limited. Alternatively, this may require the use of arbitrary limits instead of quantitative estimates. One reviewer suggested that the 'traffic light' approach could be applied using existing age composition data to identify good and poor year classes in the 1970s/1980s. This information combined with the knowledge that the 1990s represented a period of poor recruitment for many species might allow for projection of expected stock trajectories over the next few years. However, everyone acknowledged that a research program would have to be developed to determine what the critical stock level is (on a decadal scale); and what conditions may trigger a return to "good" recruitment.

The Subcommittee noted that there were very few tows in the US triennial survey that caught silvergray rockfish and that the survey trawl was designed for soft bottom rather than the hard bottom where the species is commonly found. As such, it was

considered appropriate to give a low weighting to the survey results in the assessment model used for area 3CD.

One reviewer recommended continuing with "status quo" management to provide some contrast in exploitation rates (Area 3C/D and Area 5CD) which would provide immediate (2 to 3 years) benefits in ground-truthing estimates of abundance and the population response to these levels of fishing. He also recommended and the Subcommittee concurred, initiating relative abundance surveys for silvergray rockfish. The Subcommittee suggested that plans for upcoming coastwide survey for groundfish could consider this.

There was discussion about the inclusion of "target species", as an independent variable in the general linear model analysis of commercial CPUE data. By definition, "target species" is related to the dependent variable "CPUE" and its inclusion in the analysis simply reduced the residual variance but added little to explaining interannual variability in CPUE. There were some differences in annual estimated CPUE regardless of whether or not "target species" was used. However, the Subcommittee noted that the impact of using these different series in the assessment model was minor. The population model was driven primarily by catch (total) and age composition of the catch over the 30 year time series. The Subcommittee also noted that results from the population model did not match well with the CPUE index for the last 6 years in any of the series. The author stated that because of the low weighting placed on the CPUE series. The model fit improved significantly with a low weighting on CPUE.

Conclusions

The Subcommittee accepted the yield recommendations presented in the working paper (see below). The Subcommittee noted that this assessment did not contradict the evaluation of stock status presented in the last assessment. Also, given the uncertainty around stock abundance the differences in recommended yield between the last assessment and this working paper were not significant. The Subcommittee accepted the working paper.

Recommendations

The Subcommittee accepted the yield recommendations presented in the working paper.

Area	**Yield**
3CD	244 t
5AB	476 t
5CD	432 t
5E	281 t

G2002-04: At-sea observer coverage for catch monitoring of the British Columbia hook and line fisheries

R. Haigh, J. Schnute, L. Lacko, C. Eros, G. Workman, B. Ackerman ** Paper accepted subject to revisions**

Discussion of this paper revolved around three themes, the objectives of the observer program, the use of the analyses presented in the paper and technical discussions of how data or analyses might be improved.

The Subcommittee concurred that the data were sparse and observer coverage levels were low making a thorough analysis of the issue very difficult. If the objective of the program is to arrive at an independent estimate of total catch using only observer data then estimates of observer coverage levels obtained from the current data would be biased by non-representative deployment of observers, insufficient stratification in the analysis, and small sample size effects.

There were a number of data issues highlighted during the Subcommittee discussions which reduced the utility of the analyses. It was noted that the only observed hook and line fishery with potentially sufficient observations to address the questions posed by the managers was the Halibut fishery. However, logbook data from this fishery were not available to prorate observations to the total fleet. For other fisheries, the data were insufficient to properly characterize the fisheries and thus evaluate the level of observer coverage required for the estimation of catch. There was considerable discussion about the process for converting discarded piece counts to weights and it was suggested that additional analysis be undertaken to examine the size structure of retained and discarded catch.

The methods for the evaluation of precision and bias and the recommendations for improving at-sea observer data were found to be adequate. However, the Subcommittee suggested that the fishing trip should be used as a sampling unit rather than fishing set as was done in the analysis. The Subcommittee noted that failure to incorporate Dockside Monitoring Program (DMP) estimates of landings in the analysis would result in an overestimation of observer coverage needed to estimate total catch of species where discarding is a small proportion of catch. This would not be the case, however, for species where highgrading and discarding is common. It was also noted that current coverage levels were so low that estimates of discards would be highly uncertain. The Subcommittee also noted that the level of observer coverage required is species specific, i.e. the sampling program has multiple targets.

The Subcommittee cautioned against comparing fisher log data for non-observed trips with observed trips due to the motive to misreport on non-observed trips. It was also noted that observer deployment and sampling is not random and that fishers can bias data by modifying their behavior. It was suggested that technological alternatives such as block boxes (GPS, Camera, Computer) might resolve some of these issues.

Recommendations

The Subcommittee accepted the working paper subject to revisions.

There was consensus that halibut logbook data must be acquired from the IPHC to move this work forward. It was recommended that a DFO groundfish committee on data sharing be struck and this group could interact with a counterpart at the IPHC to resolve these issues. It was pointed out that IPHC has expressed an interest in data collected by DFO observers for similar purposes.

The Subcommittee recommended that future work on the topic of total catch estimation in the hook and line fisheries should focus on obtaining discard estimates from an at-sea observer program to augment estimates of landings obtained from the DMP.

G2002-05: A review of Pacific Cod (*Gadus macrocephalus*) monitoring surveys in Hecate Strait March – July 2002

A. Sinclair and G. Workman ** Paper accepted subject to revisions**

Reviewers concluded that the paper effectively presented the design and results from the first year of a new survey which is an important contribution to monitoring and assessment of the Hecate Strait Pacific cod stock. There was general discussion by the Subcommittee concerning the presentation of the work and the issues addressed by the paper. Requested revisions included: a) stratified CPUE indices by month, which include a frequency distribution of CPUE by tow and, b) survey standard error without the finite population correction. The authors and the Subcommittee also agreed with reviewer recommendations to consider the following measures for future surveys: a) determine if the current timing of the survey is optimal (although the authors noted that the annual index will likely not be significantly affected by this), b) determine if the number of tows in the design is optimal, and c) explore the effects of including the 'skipper tows' in the survey design. One reviewer, along with Subcommittee members, expressed a concern about the potential effects on the survey design if vessels or skippers are changed. The authors suggested that this be considered before the current contract expires. Subcommittee members also supported investigation of the utility of the survey for indexing abundance of species other than cod.

Conclusions

The authors agreed to calculate the standard errors without the finite correction factor. A potential area for future consideration would be to examine the design effects of the existing stratification scheme. The Subcommittee also suggested that the authors consider a sensitivity analysis of the survey results to changes in Pacific cod abundance given the observed variability in CPUE index. The Subcommittee accepted the paper subject to revisions.

Recommendations:

1) The Subcommittee recommended continuation of the current survey design for as long as needed. It is important to maintain the monthly survey structure to ensure comparability from year to year.

2) The Subcommittee recommended initiation of discussions on management decision rules that would stem from both increases and decreases in the survey index.

3) The Subcommittee recommended investigation of the utility of the survey for indexing abundance of other species.

G2002-06: West Coast Vancouver Island Pacific Cod assessment: 2002

P.J. Starr, A.S. Sinclair, J. Boutillier **Paper accepted subject to revisions**

Subcommittee discussion of this paper focused on the spatial distribution of survey data and catch forecasting. Both reviewers expressed concern about the apparent lack of overlap between the spatial distribution of the shrimp survey and the spatial distribution of Pacific cod landings from the commercial trawl fishery in this area. The authors responded that while this was true, the survey CPUE trend exhibited good correlation with the commercial CPUE index for Pacific cod.

Discussion then focused on catch forecasts and biological reference points. For example, given the uncertainty in the estimate of B_{MSY} some members questioned the statement that a catch of 2200 t would result in a stock biomass equal to B_{MSY}. However, there was agreement in the conclusion that the stock biomass had increased recently and thus the TAC could be increased.

The Subcommittee noted that the catch forecast indicated if the catch in 2003/2004 were 0, then the stock biomass would increase by 820 t (see Table 1). Similarly, if the catch were 690 t, there would be no change in biomass.

Conclusions

The Subcommittee accepted the Working Paper.

Recommendations

The Subcommittee endorsed the authors' recommendations to:

1. Adopt yield estimates based on the model results that incorporate all three sets of available data (mean weight, shrimp trawl indices and catches). Yield forecasts and their implications on stock size are summarized in the Table below.
2. Revise the existing Pacific cod delay difference model to allow the assessment of uncertainty associated with the model parameters and predictions. An alternative

formulation where the model is conditioned on catch rather than the present formulation where it is conditioned on effort should also be investigated.

Table 1. Schedule of projected catches (in tonnes) for 2003/04 from the west coast Vancouver Island Pacific cod assessment (G2002-06) with model estimated indicators. These include: the instantaneous fishing mortality ($F_{2003/04}$) associated with each projected catch, the estimated biomass at the beginning of the next fishing year ($B_{2004/05}$), the percent change in biomass from 2003/04 to 2004/05, the percent ratio of $B_{2004/05}$ with the estimated B_{MSY}, and the percent ratio of $F_{2003/04}$ with the estimated F_{MSY}.

$\text{Catch}_{2003/04}$ (t)	$F_{2003/04}$	$B_{2004/05}$	$\Delta\% = \frac{B_{2004/05}}{B_{2003/04}} - 1$	$\frac{B_{2004/05}}{B_{MSY}}\%$	$\frac{F_{2003/04}}{F_{MSY}}\%$
0	0.00	9,240	9.8%	137%	0%
60	0.01	9,171	9.0%	136%	4%
120	0.02	9,101	8.2%	135%	8%
180	0.03	9,031	7.3%	134%	13%
240	0.04	8,962	6.5%	133%	17%
300	0.05	8,892	5.7%	132%	21%
360	0.06	8,823	4.9%	131%	26%
420	0.07	8,753	4.0%	130%	30%
480	0.08	8,684	3.2%	129%	34%
540	0.09	8,615	2.4%	128%	39%
600	0.10	8,546	1.6%	127%	43%
660	0.11	8,476	0.7%	126%	48%
720	0.12	8,408	-0.1%	125%	53%
780	0.13	8,339	-0.9%	124%	57%
840	0.14	8,270	-1.7%	123%	62%
900	0.15	8,201	-2.5%	122%	67%
960	0.16	8,133	-3.3%	121%	71%
1,020	0.17	8,064	-4.2%	120%	76%
1,080	0.18	7,995	-5.0%	119%	81%
1,140	0.19	7,927	-5.8%	118%	86%
1,200	0.21	7,858	-6.6%	117%	91%
1,260	0.22	7,790	-7.4%	116%	96%
1,320	0.23	7,721	-8.2%	115%	101%
1,380	0.24	7,653	-9.0%	114%	106%
1,440	0.25	7,585	-9.8%	113%	111%
1,500	0.26	7,518	-10.7%	112%	117%
1,560	0.28	7,450	-11.5%	111%	122%
1,620	0.29	7,382	-12.3%	110%	127%
1,680	0.30	7,314	-13.1%	109%	133%
1,740	0.31	7,246	-13.9%	108%	138%
1,800	0.32	7,179	-14.7%	107%	144%
1,860	0.34	7,111	-15.5%	106%	149%
1,920	0.35	7,044	-16.3%	105%	155%
1,980	0.36	6,976	-17.1%	104%	161%
2,040	0.38	6,909	-17.9%	103%	167%
2,100	0.39	6,842	-18.7%	102%	172%
2,160	0.40	6,775	-19.5%	101%	178%
2,220	0.42	6,708	-20.3%	100%	184%
2,280	0.43	6,642	-21.1%	99%	190%
2,340	0.44	6,575	-21.8%	98%	197%

APPENDIX 1. Working Paper Summary

G2002-02: 2002 Inshore rockfish conservation strategy for the west coast of Canada

K.L. Yamanaka and L.C. Lacko

The Rockfish Conservation Strategy (RCS) developed in 1998, brought about a change in management of inshore rockfish that incorporated the spatial effort control of closed fishing areas. The 2002 RCS defines a harvest policy that is based on a coastwide harvest rate, which is managed over the "inside" and "outside" fisheries by a combination of closed areas and TACs. Uncertainties inherent in the harvest policy may compromise inshore rockfish conservation. To counter this, it is recommended that portions of the fishing ground be closed to harvest.

The RCS harvest policy now needs to be regulated within a rebuilding strategy that has measurable target stock or harvest levels and specific timeframes. The RCS steering committee and a DFO team should be responsible for the development of a structured management system for inshore rockfish that ensures a process for measured and thoughtful decision-making.

Research in support of inshore rockfish stock assessment and management will be costly but must advance to provide the capability to monitor present fisheries and to develop fishery independent assessment in the future. Traditional fishing surveys must continue, and alongside, fishery independent surveys need to be developed and calibrated.

G2002-03: Update assessment of Silvergray rockfish (*Sebastes brevispinis*)

R. Stanley and N. Olsen

This document summarizes a re-assessment of silvergray rockfish (*Sebastes brevispinis*) in British Columbia waters and provides yield recommendations for the 2003/2004 fishing year. The catch-at-age analysis of the previous 2000 assessment was updated with two additional years of catch and proportion-at-age data, and a 2001 survey biomass estimate for the Area 3CD stock off the west coast of Vancouver Island. The assessment model for the three more northerly stocks was tuned to the last six years of commercial CPUE, unlike the un-tuned analyses conducted previously. The principal objective was to review whether the previous work had underestimated the stocks. The bias was presumed to have arisen from its over-reliance on proportion-at-age data for the three northern stocks in combination with a sparse and possibly biased array of age samples.

This review indicates terminal biomass estimates about 10% higher for the 5AB stock in Queen Charlotte Sound and 50% higher for the 5CD stock in Hecate Strait. No difference was observed for the 5E stock off the west coast of the Queen Charlotte Islands. Analysis of the 3CD stock tends to indicate a lower biomass owing to the influence of adding the 2001 survey estimate from the U.S. triennial survey. It was the lowest estimate of the time series, in some scenarios it predicted a terminal biomass for 2001 less than half of what was reported in the earlier assessment.

The large uncertainty in the analyses effectively precludes the opportunity of detecting a statistically different stock status. Nevertheless, the document recommends updating the management quotas based on the results from this review and provides a summary of harvest options.

G2002-04: At-sea observer coverage for catch monitoring of the British Columbia hook and line fisheries

R. Haigh, J. Schnute, L. Lacko, C. Eros, G. Workman, B. Ackerman

This paper takes an initial look at the hook and line observer data and is exploratory. It provides several methodologies for calculating the total catch of Inshore Rockfish (IRF) species by the hook and line fisheries: (i) the adjustment of landed catch using observed discard rates, and (ii) the prediction of total IRF catch from landed target catch, and (iii) the extrapolation of observed catch to total catch, with estimates of precision from simple random sampling theory. While the latter methodology is sound in principle, the limited availability of data and the low levels of observer coverage lead to highly biased estimates of total catch with enormous confidence intervals. Levels of observer coverage needed to attain target precision levels are derived based on the available set of observer logs. Because the current low levels of coverage are insufficient to characterize the underlying fisheries, estimates of catch and coverage derived should not be used for management purposes.

G2002-05: A review of Pacific Cod (*Gadus macrocephalus*) monitoring surveys in Hecate Strait March – July 2002

A. Sinclair and G. Workman

A stratified random bottom trawl survey has been designed and implemented to monitor changes in the abundance of Pacific cod in the Hecate Strait area in collaboration between the Canadian Groundfish Research and Conservation Society (CGRCS) and Fisheries and Oceans Canada (DFO). The survey focuses on areas of known Pacific cod distribution and consists of 5 monthly sampling trips between March and July. The first full set of surveys was conducted in 2002. The initial results are encouraging. The survey met expectations for variance of the population index with a coefficient of variation of 20%. If this can be met in future surveys, there is a good chance the survey will detect changes in population abundance of a magnitude necessary for management. The size frequency data collected were consistent with previous

observations of the stock. Juvenile fish were found primarily on the Shell Ground area where they had been reported in the past. Adult fish were found in the other main areas. This suggests that it should be possible to monitor the movement of relatively strong year-classes through the population as they recruit.

Authors Recommendations

1) Continue the current survey design for as long as needed. It is important to maintain the monthly survey structure to ensure comparability from year to year.

2) Initiate discussions on management decision rules that would stem from both increases and decreases in the survey index.

3) Investigate the utility of the survey for indexing abundance of other species

G2002-06: West Coast Vancouver Island Pacific Cod assessment: 2002

P.J. Starr, A.S. Sinclair, and J. Boutillier

The 2001 assessment of the west coast of Vancouver Island Pacific cod stock was updated for 2002 by adding an additional year of catch data and new CPUE index, incorporating abundance indices derived from a shrimp trawl survey, and converting model catch data from a calendar year basis to standard DFO fishing years (1 April to 31 March). Catch and effort data from a shrimp trawl survey operated by DFO since 1973 were analysed for consistency of coverage over the history of the survey. Tows were retrospectively assigned to strata by area and an index of abundance was calculated for each year by treating the tows as if they had been randomly sampled, weighting the stratum CPUE by the area of the stratum. The resulting indices were very similar to the indices previously estimated using an interpolation method as well as being similar to the CPUE indices calculated from the commercial fishery since 1988.

Two versions of a delay-difference assessment model were used to predict the response of the stock to varying fishing levels for the 2003/04 fishing year, one which used the shrimp trawl abundance data and the second which left out these data to maintain comparability with the 2001 assessment. The shrimp trawl index for May 2002 was used directly as an abundance index for the 2002/03 fishing year in the assessment model which used the shrimp trawl data and the index was used indirectly to predict the 2002/03 CPUE index for the assessment model which did not use the shrimp trawl data. Both models showed that the stock had increased since the previous assessment and the model catch predictions indicated that higher catches could be taken in 2003/04. The respective assessment models, with and without the shrimp trawl indices, estimated the biomass levels at the beginning of 2002/03 at 104% and 39% of B_{MSY}. Respective catch levels that maintained the same stock size between 2003/04 and 2004/05 were estimated at 690 t and 570 t for each model. The respective catch levels which corresponded to F_{MSY} were estimated at 1,290 t and 510 t for each model. The authors indicated a preference for the assessment model which

incorporated the shrimp trawl data as it included all of the available data for this stock. The authors also indicated that the B_{MSY} and F_{MSY} reference points are not well estimated and that future models should move to a Bayesian estimation framework.

APPENDIX 2: PSARC Groundfish Subcommittee Meeting Agenda NOVEMBER 12-14, 2002

DRAFT AGENDA
PSARC GROUNDFISH SUBCOMMITTEE
November 12-14, 2002
Pacific Biological Station
Seminar Room - Nanaimo, B.C.

November 12

1. Opening remarks and introductions	9:00
2. G2002-02: Inshore Rockfish assessment plan – L. Yamanaka	9:30
3. G2002-05: WCVI Pacific Cod- P. Starr and A. Sinclair	11:00
Lunch	*12:00*
4. G2002-03: Silvergray Rockfish assessment – R. Stanley	1:00
Adjournment	*4:30*

November 13

5. G2002-04: At Sea Observer coverage – R. Haigh	9:00
Lunch	12:00
6. G2002-05: Pacific Cod Monitoring – A. Sinclair	1:00
Adjournment	4:30

November 14

7. Review of SC discussion	8:30
Lunch	*12:00*
8. Workshop on Synoptic Groundfish Surveys	1:00
Adjournment	*4:30*

APPENDIX 3. List of Attendees

Subcommittee Chair: Jeff Fargo
PSARC Chair: Al Cass

DFO Participants	Tuesday	Wednesday	Thursday
* Subcommittee Members			
Acheson, Schon	✓	✓	
Ackerman, Barry*	✓	✓	✓
Bonnet, Terri	✓	✓	
Cass, Al*	✓	✓	✓
Cooke, Karina	✓	✓	
Choromanski, Ed	✓	✓	
Dunsmore, Gerry	✓	✓	✓
Fargo, Jeff*	✓	✓	✓
Gjernes, Terry*		✓	
Haigh, Rowan*	✓	✓	✓
King, Jackie*		✓	✓
Krishka, Brian		✓	
Kronlund, Rob*	✓	✓	✓
Lacko, Lisa	✓	✓	✓
MacDonald, Allan*	✓	✓	✓
McFarlane, Sandy*		✓	
Mathias, Karin	✓	✓	
Olsen, Norm	✓	✓	
Perry, Ted	✓		
Rutherford, Kate	✓	✓	
Schnute, Jon*	✓	✓	✓
Shaw, Bill*	✓		✓
Sinclair, Alan*	✓	✓	✓
Stanley, Rick*	✓	✓	✓
Workman, Greg	✓	✓	✓
Yamanaka, Lynne*	✓	✓	✓
External Participants:			
Anderson, Kelly	✓		
Ayers, Cheri	✓		✓
Dickens, Brian	✓	✓	
Glavin, Terry	✓	✓pm	✓
Harling, Wayne		✓	
Kristianson, Gerry	✓		
Koolman, John	✓	✓	✓
Lane, Jim	✓	✓	
Mose, Brian	✓	✓	✓
Ronald, Peter	✓		
Sporer, Chris	✓	✓	

Starr, Paul	✓	✓	✓
Turris, Bruce	✓		
Observers:			
Wallace, Scott	✓		✓

Reviewers for the PSARC papers presented at this meeting are listed below, in alphabetical order. Their assistance is invaluable in making the PSARC process work.

Cormier, Georges	Fisheries and Oceans Canada
Hand, Claudia	Fisheries and Oceans Canada
McFarlane, Sandy	Fisheries and Oceans Canada
Palsson, Wayne	Washington Department of Fish and Wildlife
Saunders, Mark	Fisheries and Oceans Canada
Starr, Paul	Canadian Groundfish Research and Conservation Society
Wilderbuer, Tom	NOAA
Workman, Greg	Fisheries and Oceans Canada